

C081-13424

ADDENDUM NUMBER 1

SAFETY BUILDING  
COOLING TOWER REPLACEMENT  
Site #240, Bldg. #30  
821 West State Street  
Milwaukee, WI 53233

Project Number: C081-13424

Notice Number: 6890

Date of Addendum: February 27, 2014

This Addendum to the Contract Documents is issued to modify, explain or correct the original documents, dated January 27, 2014, and is hereby made part of the Contract Documents. Acknowledge receipt of this Addendum in the space provided on the Bid Form, or bid may be rejected.

BIDDING DOCUMENTS

1. CHANGE Bid Due Date to March 12, 2014 at 2:00 P.M.
2. Document 00400, Bid Form, Alternatives: **ADD ALTERNATIVE 5** to read as follows: "State addition to Total Base Bid to provide replacement for existing condenser water pump with a new base mounted end suction style pump similar to P-2 listed on Pump Schedule. The contractor shall also include the cost of the additional materials and labor necessary to modify the existing piping to accommodate the base mounted end suction pump piping arrangement as part of this Alternative, the sum of: **REPLACE** Bid Form Pages 00400-2 and 00400-3 with revised pages 00400-2rev and 00400-3rev attached to and issued as part of this Addendum 1.

SPECIFICATIONS

1. Specification Section 01100, Summary, Paragraph A, **ADD** Sub-Paragraph D to read as follows: "Milwaukee County shall conduct an asbestos survey of the existing cooling tower panels (which appear to be Transite, a material that often contains asbestos) and associated piping affected by the scope of work of this project. Should any asbestos containing materials be found, Milwaukee County shall have the abatement performed by a qualified contractor prior to the beginning of this Cooling Tower replacement project. Contact Vijay Mehta at 414-278-4743 or Kevin O'Brien at 414-278-4832 at Milwaukee County for information."
2. Specification Section 01100, Summary, Paragraph A, **ADD** Sub-Paragraph E to read as follows: "Review of the existing site conditions indicates that the best place to locate a crane for removal of the existing cooling tower and installation of the new cooling tower will be at or near the alley-way at the northeast corner of the Safety Building along State Street. The contractor shall coordinate with Milwaukee County and shall procure all necessary permits required by local and or state ordinances regarding any closing of the alleyway or State Street necessary to facilitate location of a crane for use in this project."
3. Specification Section 01230, Alternatives, Article 1.1 C: **ADD** the following item 5.:  
Alternative 5: State addition to Total Base Bid to provide replacement for existing condenser water pump with a new base mounted end suction style pump similar to P-2 listed on Pump Schedule. The contractor shall also include the cost of the additional materials and labor necessary to modify the existing piping to accommodate the base mounted end suction pump piping arrangement as part of this Alternative.

00900-1

4. Specification Section 23 21 13, Hydronic Piping, Page 6, Part 3 – Execution, Paragraph 3.1 Piping Applications, Sub Paragraphs EE and FF. **DELETE** references to “Hot water heating piping” and **REPLACE** with “condenser / cooling tower water piping”.
5. Specification Section 23 65 13.16 Cooling Towers. **DELETE** existing Cooling tower specification section referencing “Closed-Circuit” Cooling Towers, **REPLACE** with attached Specification Section 23 65 13.16 Open Circuit, Forced Draft Cooling Towers.
6. **ADD** the attached specification section 23 25 00, HVAC Water Treatment to the construction documents.
7. Specification Section 23 09 00, Instrumentation and Control for HVAC, Page 1, Part 1 – General, Paragraph 1.1, Summary: **ADD** the following sub-paragraph C to read as follows: “The scope of controls work for this project is as follows. The existing electric / electronic and pneumatic controls shall remain in place / operation for all existing equipment associated with the existing cooling tower, condensers pump, chiller, and chilled water pumps. The Contractor shall re-use existing controls where it is appropriate for new equipment where the functionality of new equipment installed will operate to the new project specification requirements with existing controls. The Contractor shall furnish and install new controls compatible with the existing building controls where the new equipment installed as part of this project requires new controls components to function to new project specifications.”
8. Specification Section 23 09 00, Instrumentation and Control for HVAC, Page 5, Part 2 – Products, Paragraph 2.2, Control System, Paragraph A, Manufacturers: **DELETE** the following manufacturers: Carel, McQuay International, TAC Americas, INC, Tekmar Controls Systems, Inc, Tour & Andersson Control, Inc, Trane; Worldwide Applied Systems Group.

#### DRAWINGS

1. Sheet ME1: Cooling Towers Schedule: **CHANGE** the following:  
 Model Number to: S3E-8518-06L.  
 Air Entering Wet Bulb Temperature to: 78 Degrees Fahrenheit  
 Fan Motor HP to: 15 HP
2. Sheet ME1: Detail 2, Cooling Tower Piping Connections Detail. **REPLACE** the motorized control valves shown on the cooling tower inlet and outlet piping with manual shut off / isolation valves.
3. Sheet ME1: Pump Schedule: **CHANGE** the Pump Schedule to read as follows:
- |                        |                       |                       |
|------------------------|-----------------------|-----------------------|
| Plan Designation:      | P-1                   | P-2                   |
| Manufacturer:          | B & G                 | B & G                 |
| Model:                 | VSX-VSC 4x6x10-1/2A   | 1510 5BC              |
| System:                | Condenser             | Condenser             |
| Location:              | Mechanical Room       | Mechanical Room       |
| Type:                  | Cent Base Mount       | Cent Base Mount       |
| Flow Rate – GPM:       | 950                   | 950                   |
| Head Pressure – Ft WC: | 60                    | 60                    |
| Inlet Size – NPS:      | 6"                    | 6"                    |
| Outlet Size – NPS:     | 4"                    | 5"                    |
| Fluid:                 | Water                 | Water                 |
| Operating Temperature: | 95 Degrees Fahrenheit | 95 Degrees Fahrenheit |

Motor:

HP:	20	20
Max BHP:	19.04	17.77
RPM:	1780	1750
Min Efficiency:	75%	81%
Volts/Phase:	208 V / 3 Phase	208 V / 3 Phase

4. Sheet ME1: Detail 1 and Detail 3: **ADD** the following notes: "New pump bases shall be grouted full. New pump equipment pads shall be tied into floor with reinforcing bars and shall be internally structurally reinforced with reinforcing bars."

5. Sheet ME1: Pump Schedule: **CHANGE** the following: Pump P-1 information to match P-2 information for Alternative Bid No. 5.

6. Sheet ME2: Penthouse and Roof HVAC Demolition Plan. **ADD** Demolition Note 6 to read as follows: "The contractor shall be responsible for the temporary removal of all existing antennas and lightning protection devices mounted on the existing cooling towers and their associated electrical wiring and grounding cabling. The contractor shall be responsible for re-installing the existing antennas, lightning protection devices and their associated electrical wiring and grounding cabling on the new cooling tower."

7. Sheet ME3: **ADD** Keyed Note 6 to read as follows: "The contractor shall clean the existing structural steel supports free of rust and paint them with 2 coats of a weather resistant paint, color gray."

8. Sheet ME3: Keyed Note No. 5: **ADD** the following. "Automatic Chemical Feeder System shall be equivalent to Chemindustrial Systems, Inc. Model 15R X3 CTower skid mounted assembly capable of distributing 3 separate chemicals into the cooling tower water stream with integrated electronic control panel."

End of Addendum No. 1

ALTERNATIVE 1:

State addition to Total Base Bid to provide new condenser water pumps as indicated on the construction bid documents. Perform all work necessary (piping, electrical, etc) to remove existing condenser pump and install new condenser pumps, the sum of:

\_\_\_\_\_ (In words)

\_\_\_\_\_ Dollars \$ \_\_\_\_\_ (In figures)

ALTERNATIVE 2:

State addition to Total Base Bid to provide new automatic condenser water chemical feeder system as indicated on the construction bid documents. Perform all of the necessary work (piping, electrical, etc) to remove existing condenser water system automatic chemical feeder system pump and install new automatic condenser water chemical feeder system, the sum of:

\_\_\_\_\_ (In words)

\_\_\_\_\_ Dollars \$ \_\_\_\_\_ (In figures)

ALTERNATIVE 3:

State addition to Total Base Bid to provide Cooling Tower Corrosion Protection. Contractor shall provide the cooling tower with a stainless steel cold water basin as a corrosion protection measure, the sum of:

\_\_\_\_\_ (In words)

\_\_\_\_\_ Dollars \$ \_\_\_\_\_ (In figures)

ALTERNATIVE 4:

State addition to Total Base Bid for Contractor to provide Variable Frequency Drives (VFD's) for the cooling tower fans to control fan speed. Contractor shall perform all work necessary (electrical, controls, etc.) to furnish and install the VFD's on the cooling tower fans, the sum of:

\_\_\_\_\_ (In words)

\_\_\_\_\_ Dollars \$ \_\_\_\_\_ (In figures)

ALTERNATIVE 5:

State addition to Total Base Bid to provide replacement for existing condenser water pump with a new base mounted end suction style pump similar to P-2 listed on Pump Schedule. The contractor shall also include the cost of the additional materials and labor necessary to modify the existing piping to accommodate the base mounted end suction pump piping arrangement as part of this Alternative, the sum of:

\_\_\_\_\_ (In words)

\_\_\_\_\_ Dollars \$ \_\_\_\_\_ (In figures)

SUBSTITUTION OF MATERIALS

For use by Bidders at their option the following substitutions from specifically named materials or items.

MANUFACTURER'S NAME	MATERIAL	ADD/DEDUCT
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

ADDENDUM RECEIPT

We acknowledge the receipt of Addendum \_\_\_\_\_ to \_\_\_\_\_ inclusive.

BID SECURITY ACCOMPANYING PROPOSAL

**NOTE! See Instructions to Bidders - Article 9, Bid Security, subparagraph 9.1.1, filing original bid bond.**

The amount and type of bid security is as follows:

\_\_\_\_\_

COMMENCEMENT AND COMPLETION OF CONTRACT WORK

The undersigned agrees, if signatory to the Contract, to commence work upon receipt of Notice to Proceed and achieve Substantial Completion of the Work within 120 calendar days.

**NOTE! See Document 00800 - Supplementary Conditions – 8.2.3, for Liquidated Damages associated with the contract work.**

**CONTRACTORS WHO ARE SUBMITTING A BID ON WORK ARE REQUIRED TO VISIT THE SITE AND ATTEND THE MANDATORY PRE-BID CONFERENCE. FAILURE TO ATTEND THE MANDATORY PRE-BID CONFERENCE WILL RESULT IN BID BEING RETURNED UNOPENED. REFER TO DOCUMENT 00250 - PRE-BID MEETING.**

**BIDDERS SHALL SUBMIT SPECIAL QUALIFICATION DOCUMENTATION WITH BID. SEE DOCUMENT 00200 - INSTRUCTIONS TO BIDDERS, ARTICLE 16.**

## SECTION 23 25 00 HVAC WATER TREATMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Condition Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes water-treatment systems for the following:
  1. Condenser water / cooling tower piping (open system).

- B. Related Sections include the following:

#### 1.3 AUTOMATIC CHEMICAL FEED SYSTEM DESCRIPTION

- A. Open-Loop, Condenser Water / Cooling Tower Piping: Pump sequestering agent and corrosion inhibitor from solution tank into condenser water supply to tower. Use agitator as required.
  1. Intermittently feed biocide to condenser water to achieve a toxic level of the chemical to kill the organism present.
  2. Change biocides periodically to avoid chemical immunity.
  3. Activate chemical solution pump from water meter in makeup water line to cooling tower when condenser water pumps are running.
  4. Automatically feed chemical with electronic solid-state controllers.
  5. Deactivate solution pump and signal alarm by a liquid-level switch in each solution tank on low chemicals.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. The Contractor shall furnish and install an automatic condenser water / cooling tower water chemical feeder system that is capable of automatically monitoring condenser water / cooling tower water quality and automatically injecting the appropriate measured amounts of water treatment chemicals into the water stream to maintain appropriate water chemistry conditions through the operation of an electrically powered pumping system. The automatic condenser water / cooling tower chemical feed system shall be capable of generating an alarm that is able to be monitored by the facility's Building Automation System (BAS).
- B. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.
- C. Base chemical treatment performance requirements on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
  1. Condenser Water, Cooling Tower System: Maintain system essentially free of scale and total suspended solids to sustain the following water characteristics:
    - a) Copper levels to inhibit scaling.

- b) Iron levels to inhibit scaling.
- c) pH: Within a range that minimizes the potential for scaling and system corrosion.
- d) An environment in the cooling sump / cold water basin non-conductive to the growth and proliferation of biological contaminants through the use of biocide chemicals.

#### 1.5 SUBMITTALS

- A. Product Data: Include rated capacities; water-pressure drops; shipping, installed, and operating weights; and furnished products listed below:
  - 1. Pumps.
  - 2. Chemical solution tanks.
  - 3. Agitators.
  - 4. Control equipment and devices.
  - 5. Test equipment.
  - 6. Chemicals.
  - 7. Filters.
  - 8. Chemical feeders.
- B. Shop Drawings: Detail equipment assemblies indicating dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Detail power and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Maintenance Data: For pumps, agitators, filters, system controls, and accessories to include in maintenance manuals specified in General and Supplementary Specification Divisions.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is an authorized representative of the chemical treatment manufacturer for both installation and maintenance of chemical treatment equipment required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### 1.7 MAINTENANCE

- A. Scope of Service: Provide chemicals and service program for maintaining optimum conditions in the circulating water for inhibiting corrosion, scale, and organic growths in the condenser water / cooling tower piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, including the following:
  - 1. Initial water analysis and recommendations.
  - 2. Startup assistance.

3. Periodic field service and consultation.
4. Customer report charts and log sheets.
5. Laboratory technical assistance.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Chemicals: Furnish quantity sufficient to maintain cooling tower water chemistry for a period of no less than one year.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. HVAC Water-Treatment Products:
    - a) Chemindustrial Systems, Inc.
    - b) Anderson Chemical Co., Inc.
    - c) Barclay Chemical Co., Water Management, Inc.
    - d) Betz Dearborn, Inc.
    - e) DuBois Chemicals, Inc.; DuBois USA Subsidiary.
    - f) Fluids Pumps & Controllers, Inc.
    - g) Nalco Chemical Co.
    - h) Watcon, Inc.

#### 2.2 CHEMICAL FEEDING EQUIPMENT

- A. Positive-Displacement Diaphragm Pump: Simplex, self-priming, rated for intended chemical with 25 percent safety factor for design pressure and temperature.
  1. Adjustable flow rate.
  2. Thermoplastic construction.
  3. Fully enclosed, continuous-duty, motor. Comply with requirements in Division 26 Section "Motors."
  4. Built-in relief valve.
- B. Positive-Displacement Venturi Injection Pump: Metal and thermoplastic construction.
  1. Fully enclosed, continuous-duty, motor. Comply with requirements in Division 26 Section "Motors."
  2. Built-in relief valve.
- C. Positive-Displacement Piston Pump: Metal and thermoplastic construction.

1. Fully enclosed, continuous-duty, motor. Comply with requirements in Division 26 Section "Motors."
  2. Built-in relief valve.
- D. Chemical Solution Tanks: Chemical-resistant reservoirs fabricated from high-density opaque polyethylene with graduated markings.
1. Molded fiberglass cover with recess for mounting pump, agitator, and liquid-level switch.
  2. Capacity: 30 gal.
- E. Agitator: Direct drive, 1750 rpm, mounted on tank with angle adjustment.
1. Fully enclosed, continuous-duty, motor. Comply with requirements in Division 26 Section "Motors."
  2. Stainless-steel clamp and motor mount, with stainless-steel shaft and propeller.
- F. Liquid-Level Switch: Polypropylene housing, integrally mounted PVC air trap, receptacles for connection to metering pump, and low-level alarm.
- G. Packaged Conductivity Controller: Solid-state circuitry, 5 percent accuracy, linear dial adjustment, built-in calibration switch, on-off switch and light, control-function light, output to control circuit, and recorder.
- H. Solenoid Valves: Forged-brass body, globe pattern, and general-purpose solenoid enclosure with 120-V, continuous-duty coil.
- I. Electronic Timers: 150-second and 5-minute ranges, with infinite adjustment over full range, and mounted in cabinet with hand-off-auto switches and status lights.
- J. Chemical Tubing: Schedule 40, PVC with solvent-cement joints; or polypropylene tubing with heat fusion.
- K. Plastic Ball Valves: Rigid PVC or CPVC body, integral union ends, and polytetrafluoroethylene seats and seals.
- L. Plastic-Body Strainer: Rigid PVC or CPVC with cleanable stainless-steel strainer element.
- M. Condenser Water-Treatment Control Panel: Incorporate solid-state integrated circuits and digital LED displays, in NEMA 250, Type 12 enclosure with gasketed and lockable door.
1. Control dissolved solids, based on conductivity, and include the following:
    - a) Digital readout display.
    - b) Temperature-compensated sensor probe adaptable to sample stream manifold.
    - c) High, low, and normal conductance indicator lights.
    - d) High or low conductance alarm light, trip points field adjustable; with silence switch.
    - e) Hand-off-auto switch for solenoid bleed-off valve.
    - f) Bleed-off light to indicate valve operation.
    - g) Internal adjustable hysteresis or dead band.
  2. Control inhibitor feeding, based on makeup volume, and include the following:
    - a) Solid-state reset counter (accumulator), with selections from 1 to 15.
    - b) Solid-state timer, adjustable from 15 to 300 seconds.
    - c) Test switch.

- d) Hand-off-auto switch for chemical pump.
  - e) Illuminated legend to indicate feed when pump is activated.
  - f) Solid-state lockout timer, adjustable from 15 to 180 minutes, with indicator light. Lockout timer to deactivate the pump and activate alarm circuits.
  - g) Electromechanical-type, panel-mounted makeup totalizer to measure amount of makeup water.
3. Control biocide with an adjustable time programmer and include the following:
- a) 24-hour timer with 14-day skip feature to permit activation any hour of day.
  - b) Precision, solid-state, bleed-off lockout timer (zero to nine hours) and clock-controlled biocide pump timer (zero to two and one-half hours). Prebleed and bleed lockout.
  - c) Solid-state alternator to enable the use of two different formulations.
  - d) 24-hour digital display of time of day.
  - e) 14-day LED display of day of week.
  - f) Fast and slow internal clock set controls.
  - g) Battery backup so clock is not disturbed by power outages.
  - h) Quartz timekeeping accuracy.
  - i) Hand-off-auto switches for biocide pumps.
  - j) Biocide A and Biocide B illuminated legends to indicate pump is running.

### 2.3 CHEMICAL TREATMENT TEST EQUIPMENT

- A. Test Kit: Manufacturer recommended equipment and chemicals, in a carrying case, for testing pH, total dissolved solids, dissolved oxygen, biocount, chloride, and total alkalinity and for calcium hardness field tests.
- B. Corrosion Test Coupon Assembly: Constructed of corrosion material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test coupon assembly.
  - 1. Four station rack for open condenser water systems.

### 2.4 CHEMICALS

- A. Furnish chemicals recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment.
- B. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.
- C. Biocide: Chlorine release agents or microbiocides.
- D. Open-Loop, Condenser Water Piping Chemicals: Sequestering agent to inhibit scaling, acid to reduce alkalinity and pH, corrosion inhibitor, and biocide.

## PART 3 - EXECUTION

### 3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to maintain the water quality as specified in "Performance Requirements" Article.

### 3.2 INSTALLATION

- A. Install treatment equipment level and plumb.
- B. Add cleaning chemicals as recommended by manufacturer.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Confirm applicable electrical requirements in Division 16 Sections for connecting electrical equipment.
- D. Ground equipment.
  - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.4 FIELD QUALITY CONTROL

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
  - 2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
  - 3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
- B. Test chemical feed piping as follows:
  - 1. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
  - 2. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 3. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
  - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
  - 5. Repair leaks and defects with new materials and retest piping until satisfactory results are obtained.
  - 6. Prepare test reports, including required corrective action.

### 3.5 ADJUSTING

- A. Sample cooling tower water at one-week intervals after cooling tower startup for a period of five weeks, and prepare certified test report for each required water performance characteristic. Where applicable, comply with ASTM D 3370 and the following standards:
  - 1. Silica: ASTM D 859.
  - 2. Acidity and Alkalinity: ASTM D 1067.
  - 3. Iron: ASTM D 1068.
  - 4. Water Hardness: ASTM D 1126.
- B. Occupancy Adjustments: Within 12 months of Substantial Completion, perform two separate water analyses to prove that automatic chemical feed systems are maintaining water quality within performance requirements specified in this Section. Perform analyses at least 60 days apart. Submit written reports of water analysis.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.
  - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
- B. Review manufacturer's safety data sheets for handling of chemicals.
- C. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service. Refer to General and Supplementary Specification Division Sections "Contract Closeout."
- D. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service. Refer to General and Supplementary Specification Division Sections for "Operation and Maintenance Data."
- E. Schedule at least four hours of training with Owner with at least seven days' advance notice.

**END OF SECTION 23 25 00**

**SECTION 23 65 13.16  
OPEN-CIRCUIT, FORCED-DRAFT COOLING TOWERS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes factory-assembled and -tested, closed-circuit, forced-draft cooling towers.

**1.3 SUBMITTALS**

- A. Product Data: Include rated capacities, pressure drop, fan performance data, rating curves with selected points indicated, furnished specialties, and accessories.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer.
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
  - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include handrails, ladders, and equipment mounting frame.
  - 3. Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field piping and wiring connection.
  - 4. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Structural supports.
  - 2. Piping and wiring roughing-in requirements (determine spaces reserved for electrical equipment).
  - 3. Access requirements for service and maintenance.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For cooling towers to include in emergency, operation, and maintenance manuals.
- F. Warranties: Special warranties specified in this Section.

**1.4 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is certified by CTI, and that is acceptable to authorities having jurisdiction.

- B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Fabricate and label heat-exchange coils to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- E. Comply with NFPA 70.

#### 1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of open-circuit, mechanical-draft cooling towers that fail in materials or workmanship within specified warranty period:
  - 1. Fan, motor, drive shaft, bearings, and motor supports.
  - 2. Cooling Tower Media
  - 3. Cold water basin.
  - 4. External-circuit circulating pump.
  - 5. Integral controls.
  - 6. Variable Frequency Drives.
  - 7. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Baltimore Aircoil Company.
  - 2. Evapco Inc.
  - 3. Marley Cooling Tower; a United Dominion Company.

## 2.2 MANUFACTURED UNITS

- A. Description: Factory-assembled and -tested, open-circuit, induced-draft cooling tower.
- B. Cooling Tower Characteristics and Capacities: See equipment schedule on plans.

## 2.3 MATERIALS

- A. Casing Material: Galvanized sheet steel complying with ASTM A 653/A 653M, G235 coating designation.
  - 1. Corrosion Protection System: Unless otherwise specified in this section, all steel panels and structural elements shall be protected with a polymer coating. Polymer coating shall deliver the following protection when X-scribed to the steel substrate:
    - a) Salt Spray: Withstand 6,000 hours of 5% salt spray per ASTM B117 with no blistering, chipping or loss of adhesion.
    - b) Acidic and Alkaline Solutions: Withstand 6,000 hours of exposure to acidic (PH=4) and alkaline (PH=11) water solutions at 95°F with no signs of chemical attack.
    - c) Impact: Withstand 160 in-lbs per ASTM D2794 without fracture or delamination of the polymer layer.
    - d) Ultraviolet Exposure: Withstand 6,000 hours of ultraviolet radiation equivalent to 120,000 hours of noontime sun exposure with no loss of functional properties.
    - e) Thermal Shock: Withstand 200 thermal shock cycles between -25°F and 180°F with no loss of adhesion or other deterioration.
    - f) Water jet: Withstand 6,000 hours of exposure to 60psi water jet with no signs of wear or erosion.
- B. Collection Basin Material: Galvanized Steel. (BASE BID)
- C. Collection Basin Material: Welded stainless steel. (ALTERNATE BID)
  - 1. Removable strainer with openings smaller than nozzle orifices.
  - 2. Overflow connection.
  - 3. Makeup water connection.
- D. Drain Connection: Side.
- E. Cooling Tower Media Fill
  - 1. Made from self-extinguishing polyvinyl chloride (PVC) having a flame spread of 5 or less.
  - 2. The cooling tower media fill shall be impervious to rot, fungus, and decay.
  - 3. The cooling tower media fill shall be suitable for water temperatures up to and including 125 degrees Fahrenheit.
  - 4. The cooling tower media fill shall be manufactured, tested and rated by the cooling tower manufacturer and shall be elevated above the cold water level to facilitate cleaning.
- F. Drift Eliminator Material: PVC with maximum flame-spread index of 5 according to ASTM E 84.
- G. Water Distribution System: Header pipe and removable branch pipes for even distribution of water over fill.
  - 1. Pipe Material: Schedule 40, PVC.
  - 2. Nozzles: Removable plastic, brass, or ceramic nozzles with a maximum pressure drop of 12 psig

- 3. Hot-Water-Basin Control Valves: Manufacturer's standard butterfly or globe valves arranged to balance flow to each distribution basin and shut flow off during servicing.
- H. Inlet Screen Material: Stainless-steel mesh mounted in removable frames.
- I. Draft Hood Material: Galvanized steel according to ASTM A 653/A 653M, G235 coating designation with polymer coating.
- J. Draft Hood Material: Stainless steel with access door.

## 2.4 COMPONENTS

- A. Water-Level Control: Electric float switch; characteristics coordinated with solenoid-operated, makeup water valve.
- B. Fan(s): Cast aluminum, propeller.
  - 1. Drive: Belt.
  - 2. Bearings: Self-aligning ball bearings or bronze sleeve bearings with lubrication lines and fittings.
  - 3. Vibration Cutout Switch: Solid state, with adjustable time delay and NEMA 250, Type 4 enclosure.
- C. External-Circuit Circulating Pump: Close-coupled, end-suction, single-stage, bronze-fitted, mechanical seal, centrifugal pump; with a totally enclosed, fan-cooled motor; and suitable for outdoor service.

## 2.5 MOTORS

- A. Comply with requirements in Division 26 Section "Motors."
- B. Enclosure Type: Totally enclosed, air over.
- C. Motor Speed: Inverter type for variable-speed controller.

## 2.6 HANDRAILS, LADDERS, AND PLATFORMS

- A. Handrails: Galvanized steel or aluminum complying with 29 CFR 1910.23. Pipe-rail materials and fabrication are specified in Division 5 Section "Pipe and Tube Railings."
- B. Ladders and Safety Cages: Galvanized steel or aluminum complying with 29 CFR 1910.27.
- C. Platforms: Galvanized steel with a bar grating floor.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for concrete bases, anchor-bolt sizes and locations, piping, and electrical to verify actual locations and sizes before cooling tower installation and other conditions affecting cooling tower performance, maintenance, and operation.

- B. Examine proposed route of moving cooling towers into place and verify that it is free of interferences.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Vibration Isolation: Restrained spring isolators with a minimum deflection of 1". Vibration isolation devices and installation requirements are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."
- B. Maintain manufacturer's recommended clearances for service and maintenance.
- C. Loose Equipment: Install electrical components, devices, and accessories that are not factory mounted.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to cooling towers to allow service and maintenance.
- C. Install flexible pipe connectors at final connections of towers mounted on vibration isolators.
- D. Extend overflow drain and bleed lines to 6" above roof surface. Provide splash block at roof.
- E. Domestic Water Piping: Comply with applicable requirements in Division 15 Section "Domestic Water Piping." Connect to water-level control with shutoff valve and union or flange at each connection.
- F. Condenser-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Connect to supply and return cooling-tower connections with shutoff valve, flow-control valve, and union or flange on supply connection to the cooling tower and shutoff valve and union or flange to return connection from the cooling tower to the chiller.
- G. Ground cooling towers according to Division 26 Section "Grounding and Bonding."
- H. Connect wiring according to Division 26 Section "Conductors and Cables."
- I. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform field tests and inspections according to CTI's Supplement to ATC 105, "Acceptance Test Code for Closed Circuit Cooling Towers," and prepare test reports.

### 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.

- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
- C. Obtain performance tables from manufacturer.
- D. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
  - 1. Clean entire unit including basins.
  - 2. Verify that accessories are properly installed.
  - 3. Check makeup water float.
  - 4. Verify clearances for airflow and for cooling tower servicing.
  - 5. Check for vibration isolation and structural support.
  - 6. Lubricate bearings on fans and shafts.
  - 7. Verify fan wheel rotation for correct direction and for vibration or binding. Correct vibration and binding problems.
  - 8. Adjust belts to proper alignment and tension.
  - 9. Verify water level in tower basin. Fill to proper startup level.
  - 10. Start external-circuit circulating and condenser-water pumps.
  - 11. Verify operation of tower basin, makeup line, automatic freeze protect dump, and controlling device. Replace defective and malfunctioning units.
  - 12. Verify that tower discharge is not recirculating into air intakes. Recommend corrective action.
- E. Check HVAC water treatment system for proper operation, and measure chemical treatment levels. Verify operation of tower basin automatic blowdown, and controlling device.
- F. Start cooling tower and condenser-water pumps. Follow manufacturer's written starting procedures.
- G. Prepare a written startup report that records the results of tests and inspections.

### 3.6 ADJUSTING

- A. Set and balance condenser-water flow to each cooling tower inlet.
- B. Adjust water-level control for proper operating level.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site in assistance in adjusting system to suit actual occupied conditions. Provide up to four visits to site outside normal occupancy hours for this purpose.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cooling towers. Refer to Division 1 Section "**Closeout Procedures, Demonstration and Training.**"

**END OF SECTION**